Autonics

Photoelectric Sensor
BEN SERIES

INSTRUCTION MANUAL

CE

Thank you for choosing our Autonics product.
Please read the following safety considerations before use.

▣ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠ **Warning** Failure to follow these instructions may result in serious injury or death.
⚠ **Caution** Failure to follow these instructions may result in personal injury or product damage.

⚠ Warning

1. **Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss. (e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.)**
   Failure to follow this instruction may result in fire, personal injury, or economic loss.
2. **Do not disassemble or modify the unit.**
   Failure to follow this instruction may result in electric shock or fire.
3. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in electric shock or fire.
4. **Check 'Connections' before wiring.**
   Failure to follow this instruction may result in fire.

⚠ Caution

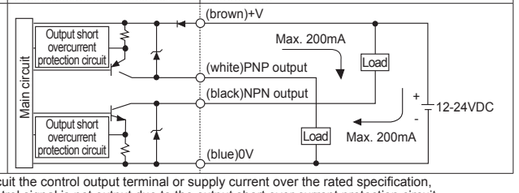
1. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
2. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
   Failure to follow this instruction may result in electric shock or fire.
3. **Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
   Failure to follow this instruction may result in fire or explosion.
4. **Do not use a load over the range of rated relay specification.**
   Failure to follow this instruction may result in insulation failure, contact melt, contact failure, relay broken, or fire.

▣ Ordering Information

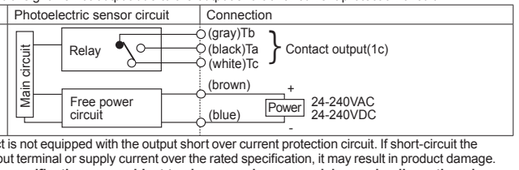
BEN 10M – T D T

Output	R	Contact output (Relay)
	T	Solid-state outputt (Transistor)
Power supply	D	DC power
	F	Free power
Sensing type	T	Through-beam
	M	Retroreflective
	P	Retroreflective with polarizing filter
	D	Diffuse reflective
Sensing distance	M	Unit: m
		Unit: mm
Item	BEN	Photoelectric sensor series

▣ Control Output Circuit Diagram

Item	Photoelectric sensor circuit	Connection
NPN/PNP 2 output (DC power)		

※If short-circuit the control output terminal or supply current over the rated specification, normal control signal is not output due to the output short over current protection circuit.

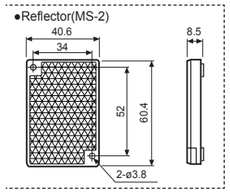
Item	Photoelectric sensor circuit	Connection
Relay contact (Free power)		

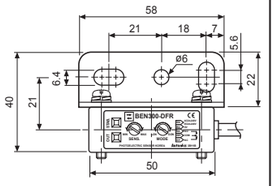
※The product is not equipped with the output short over current protection circuit. If short-circuit the control output terminal or supply current over the rated specification, it may result in product damage.
※**The above specifications are subject to change and some models may be discontinued without notice.**
※**Be sure to follow cautions written in the instruction manual and the technical descriptions (catalog, homepage).**

▣ Dimensions

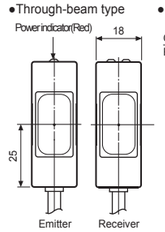
(unit: mm)

●Reflector(MS-2)

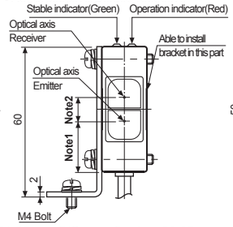


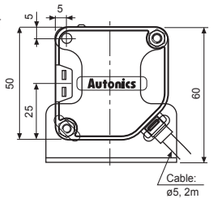


●Through-beam type



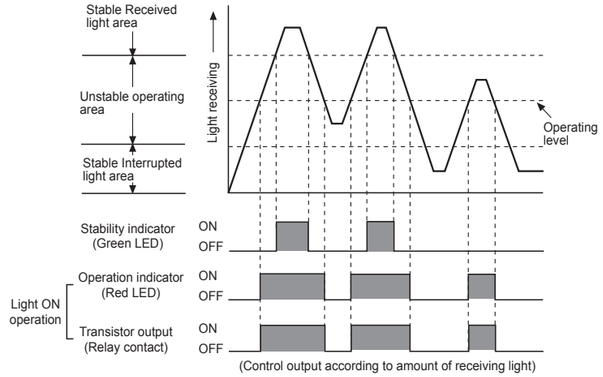
●Retroreflective/Diffuse reflective





※**Note1)**Retroreflective: 21.25mm, Diffuse reflective: 20.25mm
※**Note2)**Retroreflective: 7.5mm, Diffuse reflective: 9.5mm

▣ Timing Diagram Operation



The waveform of Transistor output and operation indicator are the state of operation for Light ON, but in case of Dark ON, it is opposite operation against Light ON.

▣ Specifications

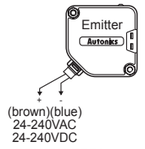
Type	Free power, Relay contact output				DC power, Solid state output			
	Through-beam	Retroreflective※1	Retroreflective※1 (with polarizing filter)	Diffuse reflective	Through-beam	Retroreflective※1	Retroreflective※1 (with polarizing filter)	Diffuse reflective
Model	**BEN10M-TFR**	**BEN5M-MFR**	**BEN3M-PFR**	**BEN300-DFR**	**BEN10M-TDT**	**BEN5M-MDT**	**BEN3M-PDT**	**BEN300-DDT**
Sensing distance	10m	0.1 to 5m	0.1 to 3m	300mm(100 x 100mm non-glossy white paper)	10m	0.1 to 5m	0.1 to 3m	300mm(100 x 100mm non-glossy white paper)
Sensing target	Opaque materials of min. ø16mm	Opaque materials of min. ø60mm		Translucent, opaque materials	Opaque materials of min. ø16mm	Opaque materials of min. ø60mm		Translucent, Opaque materials
Hysteresis	-			Max. 20% at sensing distance	-			Max. 20% at sensing distance
Response time	Max. 20ms				Max. 1ms			
Power supply	24-240VAC~ ±10% 50/60Hz, 24-240VDC⎓ ±10% (ripple P-P: max. 10%)				12-24VDC⎓ ±10% (ripple P-P: max. 10%)			
Power consumption	Max. 4VA				-			
Current consumption	-				Max. 50mA			
Light source	Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)	Infrared LED (850nm)		Red LED (660nm)	Infrared LED (940nm)
Sensitivity adjustment	-	Sensitivity adjuster			-	Sensitivity adjuster		
Operation mode	Selectable Light ON or Dark ON by switch							
Control output	Relay contact output •Relay contact capacity: 30VDC⎓ 3A of resistive load, 250VAC~ 3A of resistive load •Relay contact composition: 1c				NPN open collector/PNP open collector simultaneous output •Load voltage: max. 30VDC⎓ •Load current: max. 200mA •Residual voltage - NPN: max. 1VDC⎓, PNP: max. 2.5VDC			
Relay lifetime	Mechanically: Min. 50,000,000 operation, Electrically: Min. 100,000 operation				-			
Protection circuit	-				Reverse polarity protection circuit, output short overcurrent protection circuit			
Light receiving element	Photo IC							
Indication	Operation indicator: red, stable indicator: green (the red lamp on Emitter of through-beam type is for power indication)							
Insulation resistance	Over 20MΩ (at 500VDC megger)							
Insulation type	Double or strong insulation (mark: ⧈ Dielectric voltage between the measured input and the power: 1kV)				-			
Noise immunity	±1000V the square wave noise (pulse width: 1μs) by the noise simulator				±240V the square wave noise (pulse width: 1μs) by the noise simulator			
Dielectric strength	1000VAC 50/60Hz for 1minute							
Vibration	Mechanical	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2 hours						
	Malfunction	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 10 minutes			-			
Shock	Mechanical	500m/s²(50G) in X, Y, Z directions for 3 times						
	Malfunction	100m/s²(10G) in X, Y, Z directions for 3 times			-			
Environment	Ambient illumination	Sunlight: max. 11,000lx, incandescent lamp: max. 3,000lx (receiver illumination)						
	Ambient temperature	-20 to 65℃, storage : -25 to 70℃						
	Ambient humidity	35 to 85%RH, storage: 35 to 85%RH						
Protection structure	IP50 (IEC standard)							
Material	•Case, case cover: heat resistant ABS •Sensing part: PC (with polarizing filter: PMMA)							
Cable	ø5.0mm, 5-wire, length: 2m (emitter of through-beam type: ø5.0mm, 2-wire, length: 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: ø1.25mm)				ø5.0mm, 4-wire, length: 2m (emitter of through-beam type: ø5.0mm, 2-wire, length: 2m) (AWG22, core diameter: 0.08mm, number of cores: 60, insulator diameter: ø1.25mm)			
Accessory	Individual	-	Reflector (MS-2)	-	-	Reflector (MS-2)	-	
	Common	Adjustment screwdriver, mounting bracket, M4 bolt: 4, M4 nut: 4	Adjustment screwdriver, mounting bracket, M4 bolt: 2, M4 nut: 2		Adjustment screwdriver, mounting bracket, M4 bolt: 4, M4 nut: 4	Adjustment screwdriver, mounting bracket, M4 bolt: 2, M4 nut: 2		
Approval	-				CE			
Unit weight	Approx. 354g	Approx. 208g		Approx. 195g	Approx. 342g	Approx. 200g		Approx. 187g

※**1:** The sensing range and the sensing object of the retroreflective sensor are specified with using the MS-2 reflector. The sensing ranges of the retroreflective sensor in the above table are indentified as the possible setting ranges of the MS-2 reflector. The sensor can detect on object under 0.1m apart.
※The temperature or humidity mentioned in Environment indicates a non freezing or condensation environment.

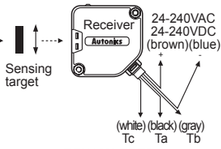
▣ Connection

Through-beam	Retroreflective	Diffuse reflective

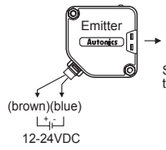
●**BEN10M-TFR1**



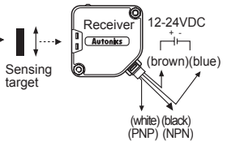
●**BEN10M-TFR2**



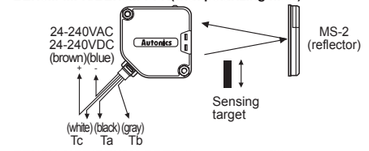
●**BEN10M-TDT1**



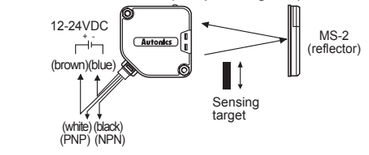
●**BEN10M-TDT2**



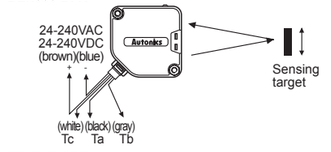
●**BEN5M-MFR/BEN3M-PFR(with polarizing filter)**



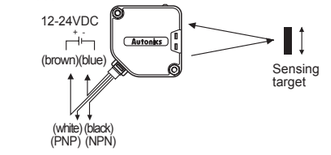
●**BEN5M-MDT/BEN3M-PDT(with polarizing filter)**



●**BEN300-DFR**



●**BEN300-DDT**



※Non-using wires must be insulated.

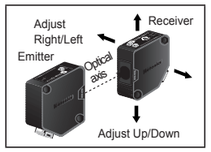
▣ Mounting and Adjustment

When using photoelectric sensors closely over two units, it may result in malfunction due to mutual interference.
When installing the product, tighten the screw with a tightening torque of 1.2N·m.

●Through-beam type

1. Supply the power to the photoelectric sensor, after setting the emitter and the receiver in face to face.
2. Set the receiver in center of position where indicator turns on, as adjusting the receiver and the emitter right and left.
3. Adjust up and down direction as the same.
4. After adjustment, check the stability of operation putting the object at the optical axis.

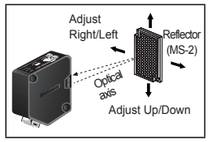
※If the sensing target is translucent body or smaller than ø16mm, it might not detect the target cause light passed.

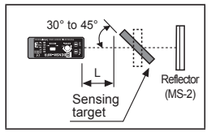


●Retroreflective type

1. Supply the power to the photoelectric sensor, after setting the photoelectric sensor and the reflector(MS-2) in face to face.
2. Set the photoelectric sensor in the position which indicator turns on, as adjusting the mirror or the sensor right and left.
3. Adjust up and down direction as the same.
4. After adjustment, check the stability of operation putting the object at the optical axis.

※If use more than 2 photoelectric sensors in parallel, the space between them should be more than 30cm.
※If reflectance of target is higher than non-glossy white paper, it might cause malfunction by reflection from the target when the target is near to photoelectric sensor. Therefore put enough space between the target and photoelectric sensor or the surface of target should be installed at an angle of 30 to 45° against optical axis. (When sensing target with high reflectance near by, photoelectric sensing with the polarizing filter should be used.)
※Sensitivity adjustment: Please see the diffuse reflective type.

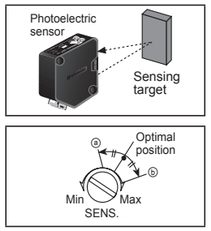




●Diffuse reflective type

1. Even though the diffuse reflective type is set at max. sensitive position, sensitivity of the sensor must be adjusted the according to the existence of the reflective material in background.
2. Set the target at a position to be detected by the beam, then turn the adjuster until point ⓐ where the indicator turn on from min. position of the adjuster.
3. Take the target out of the photoelectric sensor, then turn the adjuster until point ⓑ which the indicator turns on, if the indicator does not turn on, max. sensitive position will be point ⓑ.
4. Set the adjuster at the middle of two switching point ⓐ, ⓑ.

※The sensing distance indicated on specification chart is against 100 ×100mm of non-glossy white paper. Be sure that it can be different by size, surface and gloss of target.



▣ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.
2. When connecting a DC relay or other inductive load to the output, remove surge by using diodes or varistors.
3. Use the product, 0.5 sec after supplying power.
   When using separate power supply for the sensor and load, supply power to sensor first.
4. 12-24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
5. Wire as short as possible and keep away from high voltage lines or power lines, to prevent inductive noise.
6. When using switching mode power supply to supply the power, ground F.G. terminal and connect a condenser between 0V and F.G. terminal to remove noise.
7. When using sensor with the equipment which generates noise (switching regulator, inverter, servo motor, etc.), ground F.G. terminal of the equipment.
8. This unit may be used in the following environments.
   ①Indoors (in the environment condition rated in 'Specifications')
   ②Altitude max. 2,000m
   ③Pollution degree 2
   ④Installation category II

▣ Major Products

- Photoelectric Sensors
- Fiber Optic Sensors
- Door Sensors
- Door Side Sensors
- Area Sensors
- Proximity Sensors
- Pressure Sensors
- Rotary Encoders
- Connector/Sockets
- Switching Mode Power Supplies
- Control Switches/Lamps/Buzzers
- I/O Terminal Blocks & Cables
- Stepper Motors/Drivers/Motion Controllers
- Graphic/Logic Panels
- Field Network Devices
- Laser Marking System (Fiber, Co₂, Nd:yag)
- Laser Welding/Cutting System
- Temperature Controllers
- Temperature/Humidity Transducers
- SSRs/Power Controllers
- Counters
- Timers
- Panel Meters
- Tachometers/Pulse (Rate) Meters
- Display Units
- Sensor Controllers

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